MAPHEX
MAnure PHosphorus EXtraction System

Clinton D. Church[1], Alex N. Hristov[2], Ray B. Bryant[1], and Peter J. A. Kleinman[1]

The Phosphorus Challenge

Phosphorus is a necessary and valuable nutrient

Manure has been valued for thousands of years

However:

To much manure P in areas of surfiet cause it to be a pollutant

P sorbing soil amendments and alternative application methods (injection, etc) are temporary solutions, at best.

But, what if manure P could be concentrated enough to be economically transported?

And, what if the liquid left behind had Negligible Phosphorus ?

A Mobile Treatment System to Remove Phosphorus from Dairy Manures

Clinton D. Church[1], Alex N. Hristov[2], Ray B. Bryant[1], and Peter J. A. Kleinman[1]

[1] USDA Agricultural Research Service, [2] Pennsylvania State University - University Park, PA

Step 1: Initial Liquid/Solid Separation

Solids: 100%
Total P: 100%

Dairy manure slurry

Bulk solids

Solids: 80%
Total P: 15%
Stackable

These low P solids are ideal for reuse as bedding material

Auger press effluent

Medium sized solids

Centrifuge effluent

Solids: 10%
Total P: 45%
Stackable

These high P solids are easily transported to areas with low P

Step 2: Chemical Treatment

Chemical Treatment Tank

Fe sulfate with Polymer

Chemically treated effluent

Step 3: Final Liquid/Solid Separation

Fine sized solids

Solids: 10%
Total P: 40%
Stackable

These high P solids are easily transported to areas with low P

Final Effluent

Solids: < 0.1 %
Total P: ~0.4%

HIGHLIGHTS

- 96 – 99% P removal efficiency
- 99% solids removal efficiency
- All solids stackable (~70% moisture)
- Most nitrogen is retained (N:P ~ 50:1)
- Ideal for fertigation of crops
- pH unchanged by process

Cost for a 1000 cow dairy

Per day	$750
per cow/yr	$180
per kg P removed	$38
per lb P removed	$17

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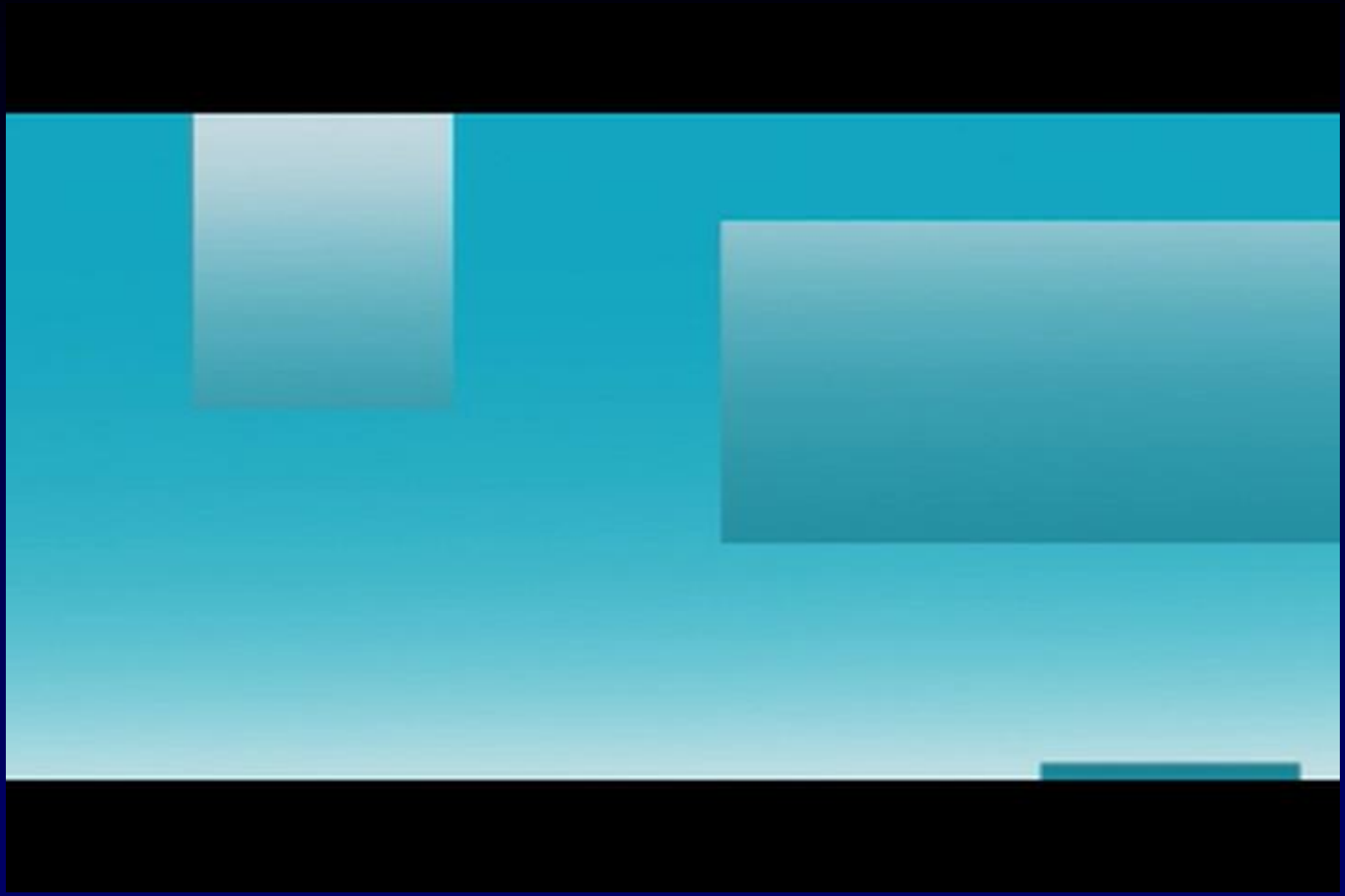

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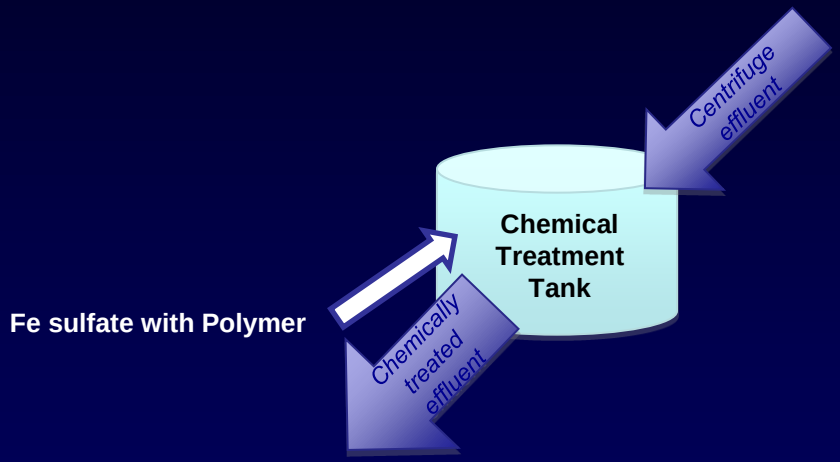

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Step 3:
Final Liquid/Solid Separation

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Total P: 40%
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Full-Scale MAPHEX System

Uses for Solids

1)Low P composted bedding from bulk solids

2) Sale of high P nutrient solids to organic farmers, mushroom growers, or retail

3) Feedstocks for energy generation

4) Innovative products (e.g. cowpots®)

Current Work

1) Testing of the Full-Scale Mobile Treatment System

2) Ongoing work to lower daily operating costs